

**APPLICATION OF PROBLEM BASED LEARNING MODEL WITH THE
SCIENTIFIC APPROACH TO IMPROVE THE UNDERSTANDING OF
MATHEMATICAL CONCEPT**



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APPLICATION OF PROBLEM BASED LEARNING MODEL WITH THE SCIENTIFIC APPROCH TO IMPROVE THE UNDERSTANDING OF MATHEMATICAL CONCEPT

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ABSTRACT

The research objective describe an improved understanding of mathematical concepts through problem-based learning model learning with scientific approach. This type of research Class Action Research (CAR) collaborative. Subject recipient of action is class X AK 1 SMK 1 Banyudono number of 36 students. Data were collected through observation, field notes, test and documentation. Data analysis technique conducted a qualitative descriptive. The results showed an increase in the understanding of mathematical concepts on the subject of trigonometry. It can be seen from the increasing indicators understanding of mathematical concepts include: 1) the ability of students to use the formula correctly before the action as much as 27.78% increase to 75%; 2) the ability of students to give examples as much as 16.67% increase to 69.44%; 3) the ability of students to use mathematical symbols as much as 11.11% increase to 77.78%; 4) the ability of students to change the story problems into mathematical models increased as much as 13.89% to 83.33%. The conclusion of this study is that the application of learning models Problem Based Learning (PBL) with a scientific approach to enhance understanding of mathematical concepts class X AK 1 SMK 1 Banyudono academic year 2014/2015.

Keywords: conceptual understanding, problem based learning, scientific

FOREWORD

Teaching and learning in schools can not be separated from the interaction between students and teachers so it is a process of communication that takes place through a two-way. Teaching is done by the teacher as an educator while learning undertaken by learners. There are important things that need to be considered in the study include learning model, liveliness, understanding concepts, communication, and learning outcomes.

Understanding the concept is one of the important things in the learning process, especially in mathematics. A student will be easier to complete the math problems after understanding the concept of the material so that they are easier to remember and apply without having to memorize formulas. But in fact there are various problems that lead to poor understanding of mathematical concepts.

The problems regarding the lack of understanding of mathematical concepts found in SMK Negeri 1 Banyudono. Most students think math is one of the subjects that are difficult to learn. In the learning process of teachers more active action while students are not much involved. Many students just listen to what is conveyed by the teacher and do not understand the concept of the material being studied as a result many students just memorize formulas. With regard to the level of understanding of the concept of students in SMK Negeri 1 Banyudono found the lack of understanding the concept of diversity issues, especially in the subjects of mathematics which include, 1) using the formula correctly 27.78%; 2) provide examples of 16.67%; 3) using mathematical symbols 11.11%; 4) change the story problems into mathematical models of 13.89%.

The root cause of the lack of understanding of mathematical concepts is influenced by several factors that can come from teachers, students, environmental, and or existing infrastructure. In general, teachers in the learning process is still acting active while students just sat quietly listening to the material presented. In addition there are many students who are lazy and passive learning in delivering his opinion. It became one of the causes of the lack of understanding of mathematical concepts in students.

Poor understanding of mathematical concepts can also be caused by the use of a less appropriate learning model. Learning model used in the delivery of material influence on the student's interest in the material being taught so that also affects the students' understanding of concepts in the material. In this regard, the root cause of the lack of understanding of mathematical concepts students most dominant is the use of a less appropriate learning model. One model of learning that can help improve the understanding of mathematical concepts is learning model Problem Based Learning (PBL) with a scientific approach.

Problem Based Learning (PBL) is a learning model that has several advantages for learning mathematics. Problem Based Learning (PBL) presents problems stemming from the real problems in daily life as learning materials so that students are able to analyze and find solutions. Duch, Allen, and White in Hamruri (2012: 148) reveals that the problem-based learning provides the conditions to improve critical thinking and analytical skills and solve complex problems in real life that will bring culture to think on students.

Permendikbud No. 65 Year 2013 on Standards for Primary and Secondary Education Process signaled the need for a learning process which is supported by the principles of scientific approach. With this approach the students would be more active and understand the mathematical concepts that exist. A scientific approach to learning includes several components as the basis of learning, which is the process of observing, ask, collect data, process, concluding, presenting and creating. The components are applied in the learning process that takes place. The scientific approach is believed to be one way to support the growth and development of attitudes, knowledge and skills of learners.

Based on the importance of students' understanding of mathematical concepts, the researcher was intrigued to conduct research using model Problem Based Learning (PBL) with a scientific approach. The purpose of this research is to improve the understanding of mathematical concepts class X AK 1 SMK 1 Banyudono academic year 2014/2015.

RESEARCH METHODS

This research is a classroom action research (PTK) or Classroom Action Research (CAR) conducted collaboratively between subject teachers and researchers in an effort to improve students' understanding of concepts through learning model Problem Based Learning (PBL) by using a scientific approach. Math teacher acts as the subject of the action, while giving researchers act as observers.

The research was conducted from planning since October 2014 to June 2015. The subject of this research action recipients are students of class X SMK AK 1 1 Banyudono.

The method used for data collection, observation, field notes, documentation and test. Observation is used to obtain a real situation during the learning process takes place on the level of students' understanding of mathematical concepts. Notes field is used to record events that occur during the learning process. Documentation includes lesson plan (RPP), a list of student names and photographs of implementation of the action. The test is used to obtain data about the increased understanding of mathematical concepts individual students according indicators that have been determined.

Data were analyzed using flow method. Traversed groove includes data reduction, exposure data, and drawing conclusions (Sutama, 2010: 44).

RESULTS AND DISCUSSION

Based on the survey results revealed that the study of mathematics through the model of problem-based learning (PBL) with a scientific approach can improve the understanding of math concepts class X AK 1 SMK 1 Banyudono academic year 2014/2015. This is evident based on data obtained through observation and the value of the test cycle I and cycle II. Indicators of students' understanding of mathematical concepts include: 1) using the formula correctly; 2) provide an example; 3) using mathematical symbols; 4) change the story problems into mathematical models.

The data obtained by researchers on understanding mathematical concepts class X AK 1 SMK 1 Banyudono through learning model Problem Based Learning (PBL) with a scientific approach of the prior action until the second cycle is presented as in Table 1 below.

Tabel 1 Increasing Understanding of Mathematical Concepts

| No | Understanding indicator Math Concepts | Before Measures | Class Action | |
|----|--|-------------------------|-------------------------|-------------------------|
| | | | Cycle I | Cycle II |
| 1 | Using the formula correctly | 10 students (27,78%) | 25 students (69,44%) | 27 students (75%) |
| 2 | Exemplify | 6 students (16,67%) | 20 students (55,56%) | 25 students (69,44%) |
| 3 | Using mathematical symbols | 4 students (11,11%) | 26 students (72,22%) | 28 students (77,78%) |
| 4 | Change the story problems into mathematical models | 5 students (13,89%) | 27 students (75%) | 30 students (83,33%) |

The graph increase students' understanding of mathematical concepts through learning model Problem Based Learning (PBL) with a scientific approach in class X AK 1 SMK 1 Banyudono before action until the second cycle can be shown in figure 2 below.

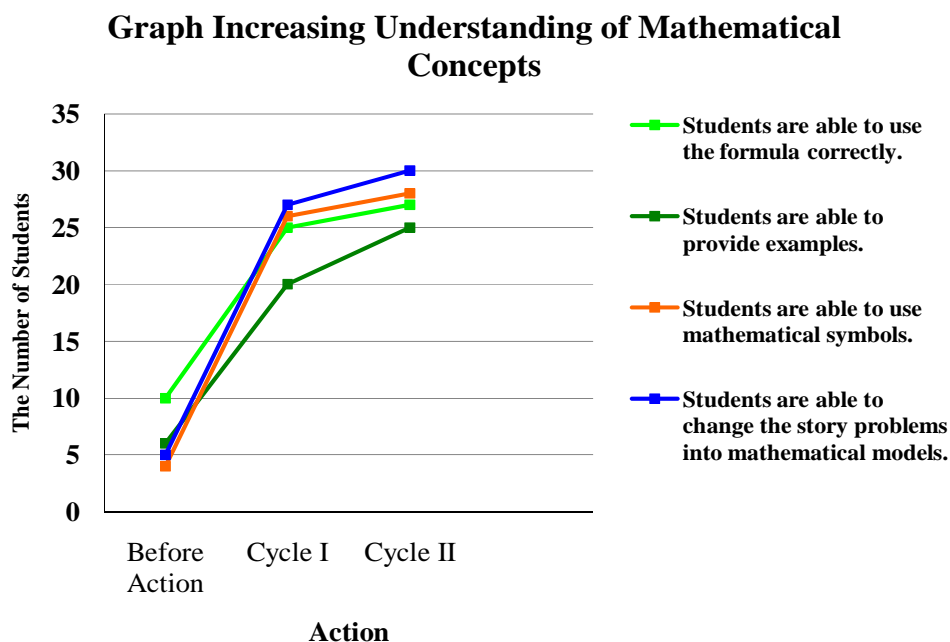


Figure 2 Graph Increasing Understanding of Mathematical Concepts

The data obtained to determine whether there is an increased understanding of mathematical concepts the students in this study detailed in the four indicators used in the following research focus.

- a. Students are able to use the formula correctly.

Based on the results of the study data showed that the percentage indicator of students using the formula correctly increased from prior to action until the second cycle and in accordance with the expectations of researchers so that it can be concluded that the students were able to use the formula correctly. In a scientific approach to process the information contained activities that are looking for solutions from a variety of sources that have one goal to develop the ability to implement procedures (Imas Kurniasih and Berlin Sani, 2014: 54). Broud and Felletti (Mohammad Jauhar, 2011: 88) states that the problem-based learning is not designed to help teachers provide as much information to students but to help students develop thinking skills, problem solving, and intellectual

skills. Of stages that exist in the teaching model of problem based learning with a scientific approach students learn to analyze existing problems and apply formulas correctly. In line with these theories that the results of this study gained through learning model problem based learning with a scientific approach able to improve students' understanding of concepts in using the formula correctly.

b. Students are able to provide examples.

This indicator is obtained through tests given after completion of learning. Based on research data can be concluded that an increase in every action taken. The percentage of students were able to give examples of indicators increased in line with expectations and researchers so that it can be concluded that the students were able to give an example. Asep Jihat and Abdul Haris (2010: 149) says that gives the example of the concept is one indicator that shows understanding of the concept. To get the skills students need a lot of information from various existing sources. According to Mohammad Jauhar (2011: 93) one of the stages of problem-based learning is organizing students to learn. The stage requires skill development cooperation among students and help each other to investigate the matter jointly. In line with this scientific approach in the students were invited to collect information from various sources through a variety of ways so that students have a lot of new information that they get. Through the stages of problem based learning model with the scientific approach students may have the ability to give another example of the problems being studied.

c. Students are able to use mathematical symbols.

This indicator is obtained through tests given after completion of learning. Based on the data in table and graph above it can be concluded that an increase in every action taken. Percentage indicators of students were able to use mathematical symbols increases and in line with expectations so that the researchers can conclude that students are able to use mathematical symbols. In the scientific approach teachers are expected to provide an opportunity for learners to communicate what they have learned (Imas Kurniasih and Berlin Sani, 2014: 53). When the students presented the results of a discussion group next class, students will learn how to write mathematical symbols correctly. In problem-

based learning model learning teachers help students to reflect or evaluation of their investigations and the processes they use (Mohammad Jauhar, 2011: 90). The evaluation of students will learn how to write mathematical symbols correctly.

- d. Students are able to change the story problems into mathematical models.

This indicator is obtained through tests given after completion of learning. Based on these data it can be concluded that an increase in every action taken. Percentage indicators of students were able to change the story problems into mathematical models to increase and in line with expectations so that the researchers can conclude that the students were able to change from one representation to another representation. According to Asep Jihad and Abdul Haris (2010: 149) is one indicator that shows understanding of the concept is expressed on a concept. In this study the indicators specified in the student's ability to change the story problems into mathematical models. Duch, Allen, and White (Hamruni, 2012: 104) reveals that the problem-based learning to provide conditions to increase the critical and analytical skills and solve complex problems in real life that will bring culture to think on students. Problems are given in problem based learning model learning a lot that comes from everyday problems so the problems are stated in the form of word problems. Through these problems students will often learn to change the question into a mathematical model before the finish.

Overall after applied learning model problem based learning (PBL) with the scientific approach can improve students' understanding of mathematical concepts from the first cycle to the second cycle. Improved understanding of mathematical concepts are clearly visible in the results of the second cycle. In the second cycle of the class action has been able to control the class teacher so well that the students become more serious in participating in learning activities. Also in this second cycle teachers were not so dominate the learning activities because students are more active. This can be seen from the number of students who dared to add advanced to the front of the class to present the results of the discussion group.

The research result is consistent with the results of research conducted by Novita Cahyaningsih (2014: 3) although with different research variables but use learning model problem based learning (PBL) with a scientific approach to improve the ability of students. Additionally opinion in line with the study proposed by Astuti Indrayani (2013: 3) which states that the application of learning strategies Think Talk Write to enhance understanding of the concepts and learning outcomes of students of class VII C MTs Al-Ishlah Pulokulon. Further research conducted by Rofinda Tauba (2014: 70) concluded that the learning model problem based learning with a scientific approach can improve communication skills math class students of SMP Negeri 1 Wedarijaksa VIIE school year 2013/2014.

In line with the results of these studies Scolastika Mariani, Wardono, and Elyn Diah Kusumawardani journal entitled The Effectiveness of Learning by PBL Assisted Mathematics Pop Up Book Against The Spatial Ability on Geometry in Grade VIII Subject Matter (2014: 531) concluded that the teaching of mathematics in material seventh grade geometry becomes more effective using PBL method with the help of Pop Up Book. Furthermore, B. Matthew Etherington in his journal titled Investigative Primary Science: A Problem Based Learning Approach (2011: 36) concluded that the method of PBL have a positive impact for teachers to teach the ideas in the context of real-world science. Another opinion was delivered by Alfred Olufemi Fatade, David Mogari, Abayomi Adelaja Arigbabu in the journal study entitled Effect of Problem Based Learning On Senior Secondary School Students' Achievements In Further Mathematics stating that Problem Based Learning (PBL) can increase student achievement levels of school SMP.

In addition, this study also supported the theory of Broud and Felletti in Mohammad Jauhar (2011: 88) states that the problem-based learning (problem based learning) is an approach to membelajarkan students to develop thinking skills and problem-solving skills, the role of adult learning authentic and become independent learners. Based on the above model of learning mathematics through problem based learning (PBL) with a scientific approach to students' understanding of mathematical concepts can be increased.

CONCLUSION

Based on the results of research and discussion, we can conclude that after using the learning model problem based learning (PBL) with a scientific approach to understanding math concepts class X AK 1 SMK 1 Banyudono increased. This can be explained as follows.

1. Being able to use the formula correctly.

Data observed prior to the study measures the number of students who are able to use the correct formula is as many as 10 students (27.78%) and after the action in the first cycle, there are 25 students (69.44%) and then in the second cycle there were 27 students (75 %) were able to use the formula correctly.

2. Able to provide examples.

Data observed prior to the study measures the number of students who are able to give examples is as much as 6 students (16.67%) and after the action in the first cycle, there are 20 students (55.56%) and then in the second cycle to 25 students (69.44%) which has been able to give an example.

3. Able to use mathematical symbols.

Data observed prior to the study measures the number of students who are able to use mathematical symbols as many as four students (11.11%) and after the action on the first cycle there were 26 students (72.22%) and then in the second cycle there were 28 students (77.78%) who have been able to use mathematical symbols.

4. Being able to change the story problems into mathematical models.

Data observed prior to the study measures the number of students who are able to change the story problems into mathematical models are as much as 5 students (13.89%) and after the action on the first cycle there were 27 students (75%) and then in the second cycle to as many as 30 students (83.33%), which is able to change the story problems into mathematical models.

BIBLIOGRAPHY

Abdurrahman, Mulyono. 2010. *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta : PT RINEKA CIPTA.

- Anggraeni, Erma Dwi. 2011. *Peningkatan Pemahaman Konsep Dan Hasil Belajar Operasi Dasar Bilangan Bulat Melalui Strategi Pembelajaran Everyone Is A Teacher Here Alat Peraga Mistar Hitung Bagi Siswa Kelas VII Semester 1 SMP Bhakti Praja Mayong Jepara Tahun Ajaran 2010/2011*. Surakarta : Skripsi FKIP UMS (Tidak diterbitkan).
- Atsnan dan Rahmita Yuliana Gazali. 2013. *Penerapan Pendekatan Scientific Dalam Pembelajaran Matematika SMP Kelas VII Materi Bilangan (Pecahan)*. Jurnal prosiding: UNY.
- Asih, Wahyu Sekar. 2010. *Inovasi Pembelajaran Matematika Dengan Penggunaan Macromedia Flash Untuk Meningkatkan Pemahaman Konsep Matematika Siswa Melalui Metode Group Investigation Di Kelas VII SMP Negeri 3 Sawit*. Surakarta : Skripsi FKIP UMS (Tidak diterbitkan).
- Bachman, E. 2005. *Metode Belajar Berpikir Kritis dan Inovatif*. Jakarta: Prestasi Pustaka
- Daryanto. 2014. *Pendekatan Pembelajaran Saintifik Kurikulum 2013*. Yogyakarta: Gava Media
- Depdikbud. 2013. *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 81A tahun 2013 tentang Pedoman Umum Pembelajaran*. Jakarta: Depdikbud
- Ernawati. 2011. *Peningkatan Minat Belajar Siswa Dalam Pembelajaran Matematika Melalui Pendekatan Resource Based Learning (PTK Di Kelas VII SMP Negeri 2 Colomadu Tahun Ajaran 2010/2011)*. Surakarta : Skripsi FKIP UMS (Tidak Diterbitkan).
- ET. Ruseffendi. 1980. *Pengajaran Matematika Moderen Untuk Orang Tua, Murid, Guru dan SPG*. Bandung: Tarsito.
- Etherington, Matthew B. 2011. *Investigative Primary Science: A Problem Based Learning Approach*. Australian Journal of Teacher Education. Vol 36: Iss. 9. Article 4.
- Faturrahman. dkk. 2012. *Pengantar Pendidikan*. Jakarta: PT Prestasi Pustakarya.
- Hartono, Rudi. 2013. *Ragam Model Mengajar Yang Mudah Diterima Murid*. Jogjakarta: DIVA Press.
- Hamidani. 2011. *Dasar-Dasar Kependidikan*. Bandung : CV Pustaka Setia.

- Hamruni. 2012. *Strategi pembelajaran*. Yogyakarta : Insan Madani.
- Henry Khat. 2010. *A Grounded Theory Approach: Conceptions Of Understanding In Engineering Mathematics Learning*. Volume 15 Number 6 November 2010. Singapore Polytechnic, Singapura: The Qualitative Report.
- Hartono, R. 2013. *Ragam Model Mengajar Yang Mudah Diterima Murid*. Yogyakarta: Diva Press
- Jauhar, Mohammad. 2011. *Implementasi PAIKEM dari Behavioristik sampai konstruktivistik: Sebuah Pengembangan Pembelajaran Berbasis CTL (Contextual Teaching & Learning)*. Jakarta: Prestasi Pustaka.
- Jihad, A dan Abdul Haris. 2008. *Evaluasi Pembelajaran*. Yogyakarta: Multi Pressindo
- Kurniasih, S dan Berlin Sani. 2014. *Sukses Mengimplementasikan Kurikulum 2013: Memahami Berbagai Aspek Dalam Kurikulum 2013*. Kata Pena
- Mariani, Scolastika Wardono, dan Elyn Diah. 2014. *The Effectiveness of Learning by PBL Assisted Mathematics Pop Up Book Againsts The Spatial Ability in Grade VIII on Geometry Subject Matter. International Journal of Education and Research Vol. 2 No. 8 August 2014*. ISSN: 2201-6333.
- Masykur, Moch dan Fathani, Abdul Halim. 2007. *Mathematical Intelligence : Cara Cerdas Melatih Otak Dan Menanggulangi Kesulitan Belajar*. Jogjakarta : Ar-Ruzz Media.
- NCTM. 1989. *Curriculum and evaluation standard for school mathematics*. Reston, Virginia: NCTM.
- Retnowati, Dwi dan Budi Murtiyasa. 2013. *UPAYA MENINGKATKAN PEMAHAMAN KONSEP DAN DISPOSISI MATEMATIS MENGGUNAKAN MODEL PEMBELAJARAN TREFFINGER*. Seminar Nasional Pendidikan Matematika. UMS.
- Sagala, Syaiful. 2006. *Konsep Dan Makna Pembelajaran Untuk Membantu Memecahkan Problematika Belajar Dan Mengajar*. Bandung: Alfabeta.
- Sanjaya, Wina. 2013. *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana.

- Schettino, Carmel. 2012. *Teaching Geometry Through Problem-Based-Learning. Mathematics Teacher*. Vol. 105 No. 5. Januari 2012.
- Subadi, Tjipto. 2013. *Lesson Study Sebagai Inovasi Pendidikan*. Kartasura: Kafilah.
- Sumarjono. 2004. *Konsep Dan Makna Pembelajaran*. Bandung : Remaja Rosdakarya.
- Susilowati, Erna. 2011. *Penerapan Strategi Pembelajaran Poster Session Untuk Meningkatkan Keaktifan Dan Pemahaman Konsep Sistem Persamaan Linear Dua Variabel (SPLDV) (PTK Pembelajaran Matematika Di Kelas VIII Semester 1 SMP Negeri 2 Selogiri)*. Surakarta : Skripsi FKIP UMS (Tidak Diterbitkan).
- Sutama. 2010. *Penelitian Tindakan Kelas*. Semarang : CV. Citra Mandiri Utama.
- Taubah, Rofinda. 2014. *Implementasi Pendekatan Sainifik Dengan Model Problem Based Learning Untuk Meningkatkan Komunikasi Matematika (PTK Siswa Kelas VII E SMP Negeri 1 Wedarijaksa Tahun Ajaran 2013/2014)*. Surakarta : Skripsi FKIP UMS (Tidak Diterbitkan).
- Trianto. 2011. *Model-model Pembelajaran Inovatif Berorientasi Konstruktivistik*. Jakarta: Prestasi Pustaka
- Wijaya, Ariyadi. 2012. *Pendidikan Matematika Realistik : Suatu Alternatif Pendekatan Pembelajaran Matematika*. Yogyakarta : Graha Ilmu.